3.1.8. OZONESONDE OBSERVATIONS

Ozone vertical profile measurements using ozonesondes were continued at SPO, MLO, and Boulder. A continuing goal of the measurements was an assessment of the effect of the Mt. Pinatubo eruption on the ozone distribution in the stratosphere. At SPO the continued presence of significantly elevated H_2SO_4/H_2O aerosol in the lower stratosphere led to unprecedentedly low column ozone amounts during austral spring 1993 [*Hofmann et al*., 1994*a*]. During September 25 to October 18, there were eight consecutive profile measurements with integrated ozone amounts (total column ozone) less than or equal to 100 DU. These were the lowest column ozone amounts ever recorded. In the region of 17-19 km, essentially all of the ozone was destroyed (Figure 3.10). This represented a vertical extension of the region of ozone loss. In the lower portion of the depletion region (below 16 km) the additional depletion is associated with the presence of Mt. Pinatubo aerosol and the efficient destruction of ozone at temperatures warm enough that polar stratospheric clouds (PSCs) do not form, but where the sulfate aerosol is an effective medium for heterogeneous chemical processing. At altitudes above 20 km, the additional depletion appears to be the result of colder temperatures that enhance the formation of PSCs [*Hofmann et al*., 1994*a*].

In late 1993 and early 1994 Boulder saw the recovery of ozone in the lower stratosphere to levels seen prior to the eruption of Mt. Pinatubo (Figure 3.11). This was consistent with the significant drop in the particle surface area of the stratospheric aerosol in the mid-latitudes beginning in the middle of 1993 [*Hofmann et al*., 1994*b*]. The timing of the ozone recovery with the drop-off in particle surface area lends credence to the argument that the low ozone anomaly seen following the eruption of Mt. Pinatubo was a result of the processing of human-produced chlorine on sulfate aerosol in the lower stratosphere.

At MLO ozonesonde measurements began in September 1982 but were discontinued in January 1984 and not resumed until December 1984. Profiles were obtained on about a three-per-month schedule since then. Figure 3.12 shows the trend for the 12-year period beginning in 1982 for levels from the surface to 7 mb. The largest changes are decreases in the lowest part of the stratosphere and upper troposphere, although these trends are not generally significant. Above 30 km at the highest levels routinely attained by the ozonesonde, there are significant increases. The trends in the lower stratosphere are similar in magnitude to those seen at midlatitude northern hemisphere sites during this period [*Logan*, 1994]. It is not clear whether the declines in the upper troposphere are related to those in the lower stratosphere. The extensive Canadian ozonesonde network also shows significant decreases in the troposphere as well as the lower stratosphere [*Tarasick et al*., 1995].

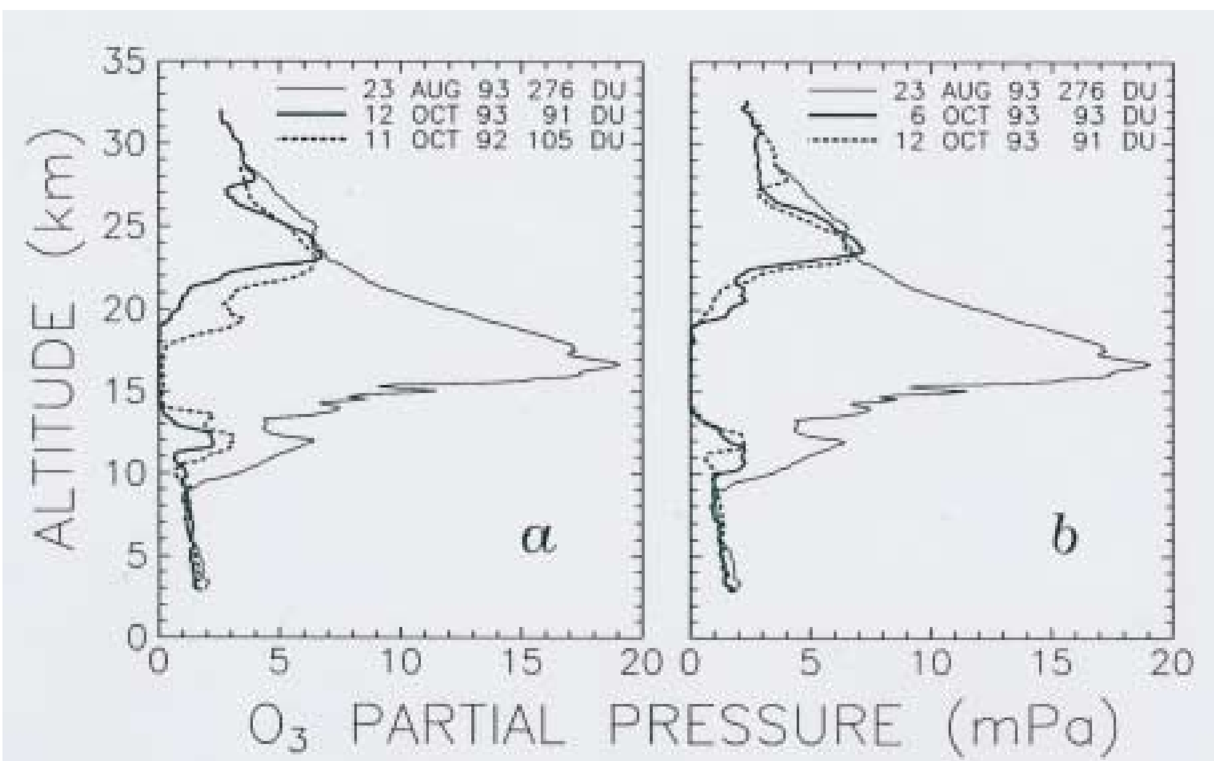

Fig. 3.10. (*a*) Comparison of the pre-depletion ozone profile at South Pole in 1993 with profiles when total ozone reached a minimum in 1992 and 1993. (*b*) Comparison of the pre-depletion profile with two profiles which showed total ozone destruction in the 14-19-km region.

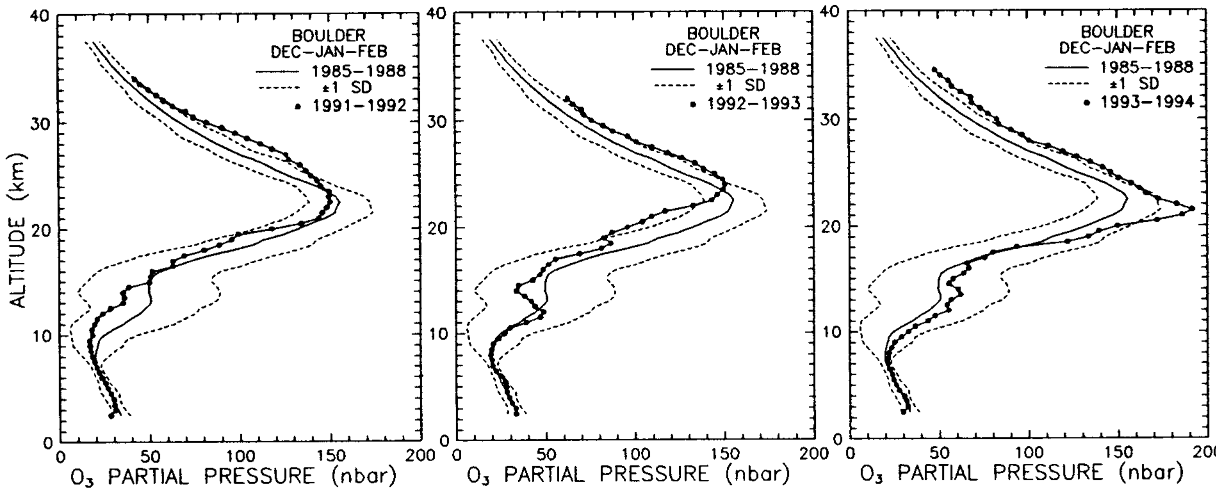

Fig. 3.11. Winter average ozone partial pressure profiles at Boulder, Colorado, after the eruption of Mt. Pinatubo (points connected by heavy solid lines). The thin-solid and dashed profiles represent the 1985-1988 seasonal averages plus and minus one standard deviation.

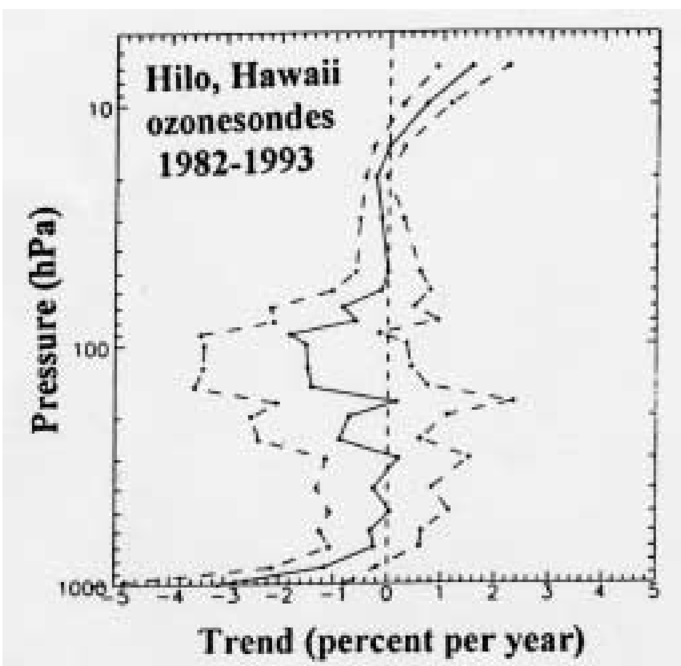

Fig. 3.12. The linear trend (solid line) and 95% confidence interval (dashed line) of the ozone monthly departures as a function of altitude at Hilo, Hawaii, for the period 1982-1993.